INTERNATIONAL METEOROLOGY.

Accompanying the present *Review* will be found three International charts, Nos. IV, V, and VI, representing the meteorological conditions over the northern hemisphere and portions of the southern hemisphere.

No. IV indicates the probable course of the principal storm areas over the Atlantic ocean during the month of *January*, 1880, which have been traced from observations made on board about 110 vessels, and which have been collected from various sources or received directly at this office, up to March 5th, 1880. The following is a short description of these areas and of the meteorological conditions existing over the northern portion of the North Atlantic ocean during January, 1880. On the first of the month the area (No. I) of low pressure passed northeastward to the north of Scotland. This area was the same as described in the *Review* for December, as low area No. XIX and was encountered on December 31st by S. S. *Leipzig* in about 47° N., 37° W. (barometer 29.20 inches, or 741.7 mm.) This vessel reports "at 1.30 p. m. a sudden calm, and fifteen minutes later wind NNE., at first in heavy squalls, increasing to hurricane violence, with rapidly increasing northerly sea and heavy hail and snow squalls; towards evening wind and sea decreased, and at 8 p. m. the barometer read 30.22" or 767.6. S. S. *Indiana* reports December 31st, 48 N. 44 W., barometer 29.38 or 746.3, wind NNW, force 9, hard rain. In the Orkneys a gale from the SW. set in on the night of the 1st, changing on the 2nd to W., with heavy snow. Low area No. II passed rapidly southeastward from the neighborhood of Hudson's Bay to Cape Sable during the 31st of December and was described as area No. XX in the *Review* for the month. On January 1st it passed eastward south of Nova Scotia, where it was encountered by S. S. *Hibernian* in 45° N., 58° W., which vessel reported "fresh SE gale, with heavy snow, latter part wind NNE. barometer 29.19 or 741.4. On the 2nd it passed to the north of parallel 50° N, and was quickly followed by area No. III, (No. II of the January *Review*) which passed over Newfoundland on the night of the 3rd, and on the 4th curved to the northeast. This area was, in its turn, quickly followed by No. IV, (No. III of the January *Review*) which passed eastward over Nova Scotia on the early morning of the 5th, and on the 6th was encountered by S. S. *Algeria* in 48° N., 32° W., which vessel reported barometer 29.33 or 745.0, with "wind shifting in a heavy squall from south to west by south." On the 7th this area also curved to the northwards about the 30th meridian and on the 8th, higher pressures, with diminishing westerly gales, prevailed over the western Atlantic, terminating a period of exceedingly stormy weather over this region, which set in about the 21st of December. Stormy weather, with heavy seas, continued over a small area during the 9th, 10th, and 11th, about 50° N. and 20° to 30° W.; Bark *Water Lilly* encountered a "whirlwind" on the 9th about 60 miles south of the Bermudas, and on the night of the 11th heavy rains, resulting in disastrous floods, occurred at the island of St. Kitts, W.I., but elsewhere over the Atlantic only occasional gales were reported during these days. On the 12th, low area No. V (No. VII of the January *Review*) moved off the coast of the United States, and on the 13th passed northeastward between the Bermudas and Nova Scotia, apparently increasing somewhat in energy; on the 14th it moved eastward south of Nova Scotia, and from the 16th to 17th eastward along the 40th parallel, increasing in area, and with easterly to northerly winds over the Atlantic near the parallel of 50. S. S. *Ohio* sailed from Bremerhaven on the 11th, barometer 30.73 or 780.4, and had constantly falling pressure, with easterly or southerly winds until the 17th, when in 39° N., 25° W. the barometer read 29.80 or 756.9, wind SSW. On the 18th, in 37° N., 28° W. the wind, as reported by the *Ohio*, veered to the W, force 6, and the barometer fell to 29.65; on the 19th, same vessel, in 35° N., 32° W., at 7.35 a. m., Washington time, the pressure had fallen to 29.57 or 751.0, and the wind had veered to NW., force 8. Reports have not yet been received from the Azores, but at Funchal, Madeira Islands, the pressure fell rapidly, with southerly winds, from the 16th to the 19th, when it reached 29.67 or 753.6; southerly winds and low but slowly rising pressure prevailed at this station until the 23rd, when the wind changed to N., with rising barometer. S. S. *Hibernian* sailing from 51° N., 35° W., on the 19th, to 52° N., 6° W., on the 24th, had continued easterly winds, varying in strength from force 4 to 7; the pressure on this vessel was about 29.85 or 758.1 from the 19th to the 21st in 52° N., 25° W., after which it rose. On the 18th, area No. VI was central between the coast of the United States and the Bermudas; on the 19th it moved northward as a somewhat severe storm, being encountered by S. S. *Leipzig* in 40° N., 61° W., and by S. S. *Caspian* in 41° N., 67° W., the former vessel reporting SW. winds, force 7, and the latter NNE., force 5. During the night of the 19th this storm passed northward over Newfoundland. No. VII is a continuation of area No. XI of the January *Review*; it probably moved eastward during the 23rd and 24th, attended by cloudy and rainy weather, and followed by northwesterly gales. S. S. *Nederland* reported low pressures and stormy winds on the 28th in 50° N., 22° W., and on the 30th in 47° N., 31° W., and the S. S. *Sarmatian*, on the 29th, in 48° N., 43° W., had barometer 28.89 or 733.8 mm., with WSW. wind, force 8, rain and very heavy sea, but reports as yet to hand are not sufficiently numerous to allow the tracks of these storms being charted.

On this chart will also be found a short track over the Pacific ocean showing the position of a cyclone encountered on the 28th of *November*, 1879, by the U. S. S. *Ranger*. The following are the positions of the vessel on three days (Greenwich dates,) the 27th and 29th being from observation and the 28th by dead reckoning:—27th, in 39° 38′ N., 175° 50′ E; 28th, 38° 33′ N., 176° 38′ E.; 29th, 38° 17′ N., 177° 32′ E. Below is a table of hourly observations from midnight of the 27th to 10 p. m. of the 29th, with the ship's compass course and speed, as copied from the log and from an interesting report of the storm furnished this office by Lt. W. P. Randall, U. S. N., executive officer, U. S. S. Ranger:

Date.	Hours.	Knots.	Courses Steered.	Winds. Direction.	Force.	Leeway.	Barometer. Height in inches.	Thermometer attached.	Temperature. Air, Dry Bulb.	Air, Wet Bulb.	Water at Surface.	Weather by Symbols.	Clouds by Symbols.	Clear sky in 10ths.	State of Sea.
27th..	Mid.	4.0	N.	ENE.	4,5	½	29.92	70	58	57	59	bc.	Cir. Cum.	3	S.
28th..	1 a. m.	1.8	SE.	E. x N.	4,5	½	29.88	71	60	58	59	o. c.	Cum. Nim.	0	M.
	2 a. m.	5.2	SE. ¼ S.	ENE.	6	½	29.85	69	60	58	59	ocd.	Cum. Nim.	0	M.
	3 a. m.	6.0	SE. ½ S.	ENE.	6	½	29.82	69	59	57	59	ocd.	Cum. Nim.	0	M.
	4 a. m.	5.6	SE. ¼ S.	NE. x E.	6	½	29.79	69	59	57	59	ocd.	Cum. Nim.	0	M.
	5 a. m.	5.6	SE. ¼ S.	ENE.	6,7	1	29.75	66	59	57	59	ocq	Cum. Nim.	0	M.
	6 a. m.	5.8	SE. x S.	E. x N.	6,5	1	29.73	66	59	57	59	ocq.	Cum. Nim.	0	M.
	7 a. m.	6.0	SE. x S.	E. x N.	6	1	29.70	69	60	58	59	oc.	Cum. Nim.	0	M.
	8 a. m.	6.4	SSE. ½ E.	E. x N.	6	1	29.71	71	60	58	59	oc.	Cum. Nim.	0	M.
	9 a. m.	6.5	SE. ½ S.	E. x N.	6	1	29.70	72	61	59	59	oc.	Cum. Nim.	0	M.
	10 a. m.	4.6	SSE. ½ E.	E. x N.	6	1	29.65	70	61	60	59	op.	Cum. Nim.	0	M.
	11 a. m.	4.0	SSE. ½ E.	E. x N.	6	1	29.60	68	62	61	59	od.	Cum. Nim.	0	M.
	Noon.	3.5	SSE.	E. x N.	6	1	29.47	68	61	61	59	od.	Cum. Nim.	0	M.
	1 p. m.	3.0	NW.	E.	5	1	29.44	69	63	62	60	ocqr.	Nim.	0	R.
	2 p. m.	2.0	N. ¾ E.	E.	5	2	29.38	68	62	61	60	ocqr.	Nim.	0	R.
	3 p. m.	1.8	N. x E.	E.	4,5	2	29.33	67	62	61	60	ocqr.	Nim.	0	R.
	4 p. m.	2.0	NNE.	ESE.	4,5	2	29.29	66	62	61	60	ocqr.	Nim.	0	R.
	5 p. m.	2.5	NE. x E.	E.	3,4	2	29.26	68	63	61	61	ocqr.	Nim.	0	L.
	6 p. m.	2.0	NE.	E.	3,4	1	29.14	68	63	61	60	ocqr.	Nim.	0	L.
	7 p. m.	3.2	N. x E. ½ E.	ESE.	4	½	29.10	68	64	63	60	op.	Nim.	0	L.
	8 p. m.	3.6	NE. x E.	SE. x S.	4	½	29.01	69	65	64	60	op.	Nim.	0	L.
	9 p. m.	4.4	E.	S.	5,6	½	28.84	69	66	65	60	opq.	Cum. Nim.	0	R.
	10 p. m.	4.0	E.	S. x W.	5,7	1	28.72	69	64	64	60	opq	Cum. Nim.	0	R.
	11 p. m.	2.5	SE. x E.	SW.	5,7	1	28.70	66	64	64	60	ocqp.	Cum. Nim.	0	R.
	Mid.	3.8	SE. x E. ½ E.	WSW.	6,8	1	28.63	68	64	64	60	ocqp.	Cum. Nim.	0	R.
29th..	1 a. m.	3.4	ESE.	WSW.	6,9	3	28.66	63	60	57	60	ocqp.	Cum. Nim.	0	R.
	2 a. m.	3.0	S. ½ W.	W. x S.	9,11	8	28.75	62	59	57	60	ocqr.	Cum. Nim.	0	R.
	3 a. m.	3.0	S. ½ W.	W. x S.	9,11	8	28.85	62	58	56	60	ocqr.	Cum. Nim.	0	R.
	4 a. m.	3.0	S. ½ W.	W. x S.	10,9	8	29.05	60	58	57	60	ocqp.	Cum. Nim.	0	R.
	5 a. m.	2.5	S. x W.	W. x S.	9	7	29.12	62	58	57	60	bcq.	Cum. Nim.	0	H.
	6 a. m.	2.5	S. x W.	W. x S.	9	6	29.20	63	58	57	60	bcq.	Cum. Nim.	0	H.
	7 a. m.	2.5	S. x W.	W. x S.	9	6	29.30	63	58	57	60	bcq.	Cum. Nim.	0	H.
	8 a. m.	2.0	S. x W.	W. x S.	9	6	29.38	63	58	57	60	bcq.	Cum. Nim.	0	H.
	9 a. m.	2.0	SSW.	W. x N.	6,9	4	29.44	64	58	57	60	bcqp.	Nim.	0	H.
	10 a. m.	2.0	SSW.	W. x N.	6,8	4	29.56	64	57	56	60	bcqp.	Nim.	0	H.
	11 a. m.	2.0	SSW.	W. x N.	6,8	4	29.68	61	57	56	60	bcqp.	Nim.	0	H.
	Noon.	2.0	SSW.	W. x N.	8,10	4	29.62	59	56	55	60	ocqr.	Nim.	0	H.
	1 p. m.	2.0	SSW.	W. x N.	8,10	5	29.61	59	56	54	60	ocqr.	Nim.	0	H.
	2 p. m.	2.0	SSW.	W. x N.	8,10	5	29.65	60	56	53	60	ocqr.	Nim.	0	H.
	3 p. m.	2.0	SSW.	W. x N.	8,10	5	29.72	60	56	53	60	boq.	Nim.	3	H.
	4 p. m.	2.0	SSW.	WNW.	8,10	5	29.72	60	55	53	60	boq.	Nim.	5	H.
	5 p. m.	2.0	SW. x S.	WNW.	8,10	6	29.74	59	54	52	59	boq.	Cum.	8	H.
	6 p. m.	2.0	SW. x S.	WNW.	8,10	6	29.78	63	53	51	59	boq.	Cum.	8	H.
	7 p. m.	2.0	SW. x W.	WNW.	7,8	3	29.78	65	54	51	59	boq.	Cum.	6	H.
	8 p. m.	2.0	SW. x W.	WNW.	8,9	3	29.84	63	54	51	59	boq.	Cum.	6	H.
	9 p. m.	2.4	SW.	WNW.	7,9	4	29.87	63	53	51	59	boq.	Cir. Cum. Nim.	4	H.
	10 p. m.	2.2	SW.	W. x N.	6,9	5	29.92	58	52	50	59	bcpq.	Cir. Cum. Nim.	3	H.

It is remarked that the easterly winds, in advance of the centre of cyclone, were only fresh to strong breezes except heavy squalls (force 7) at 5 a. m., and that as the wind veered to southwesterly it increased to a heavy gale, with very heavy seas, during which the decks were swept and considerable damage done to vessel. S. S. *Lackawanna*, at 7:35 a. m., Washington mean time, of the 29th, was in 34° 38′N., 160° 12′E., and reported barometer 29.65 (aneroid) wind WSW., force 5–6, cloudy, and long sea swell from the WSW.

Chart No. V shows, by isobaric and isothermal lines, the mean pressure and temperature for the month of *July*, 1878, at 7:35 a. m., Washington mean time, as deduced from the International Simultaneous Observations. The barometer observations have been corrected for temperature and reduced to sea-level. For stations lying outside the area included within the lines and for those in the Southern Hemisphere, the means are shown by figures, indicating the temperature in degrees, Fahr., and the pressure in English inches. The paucity of observations over the Pacific ocean is to be regretted, but it has been thought better to draw a few lines, indicating the means of observations received, than to leave the space blank. If these means are considered as fair approximations to the monthly means, the area of highest pressure over the Northern Hemisphere, for this month, will be found covering the greater part of the eastern half of the North Pacific ocean; the maximum readings (about 30.50 inches, or 774.7 m. m.) occurring in the ten degree square, bounded by the parallels 30° and 40° N., and meridians of 140° and 150° W. The prevailing winds over this region show a decided circulation around this centre of elevation, being northwesterly off the American coast; northeasterly, brisk to high, along the 25th parallel westward to the Honolulu Islands, and southerly from the northwestern margin of this high pressure area to Behring Sea. The second area of maximum pressure is found over the North Atlantic ocean, central to the southwest of the Azores, the means at Punta Delgada and Angra, being respectively, 30.32, or 770.1 and 30.31, or 769.9. The low area over the North Atlantic, having continued its journey northward, is central to the north of the extreme stations, viz.: Godthaab and Stykkisholm, where the prevailing winds are southerly. An interesting feature of the distribution of the atmospheric pressure over the North Atlantic during the four months, April, May, June and July, is found in the gradual northward motion of the high and low pressure areas, until the centre of the high pressure of July is found to occupy nearly the same geographical position as the centre of the low area of April. Over western Europe and Asia, excepting the east and south portions of Hindostan, the mean pressure is decidedly lower than during the preceding month of June, with an easterly motion of the central depression. The area of low, which during

the month of June occupied the central northern portion of Hindostan, moved to the eastward, and during July is found over the Province of Scinde, the mean for the latter month exceeding that of the former at all the India stations except Agra, Bombay, Deesa and Kurrachee. The west monsoons and heavy rains which set in along the Bombay coast during June increased throughout July, the rainfalls at the stations Bombay and Poona, for these months, being, respectively, for June, 19.82 and 1.94 inches, and July, 48.24 and 10.53 inches. Along the Bengal coast the southerly monsoons continued to blow throughout the month, while in the upper valley of the Ganges, the Northwestern Provinces, the northwesterly winds of June gave way to the easterly winds of July. Over Siberia and Russia the lowest pressures are found at Kasan and Ekaterinburg, around which stations a decidedly circular motion of the winds is observable.

On chart No. VI are traced the paths of the principal storm areas which traversed the northern hemisphere during the month of *July*, 1878. The general distribution of these tracks agrees with the areas of mean low pressure shown on chart No. V, while their general direction is easterly, inclining towards the northeast over the oceans and towards the southeast over the land areas. The tracks over the Behring sea region and Alaska are based upon tri-daily observations at St. Michael's and St. Paul's Island, and are probably nearly correct, while the succession of meteorological changes occurring at these stations, at those in Washington Territory, and at York Factory, B. A., indicate a connection between some of these areas and those moving eastward over British America.

TEMPERATURE OF THE AIR.

The general distribution of temperature for February, 1880, is shown by the isothermal lines on chart No. II. As in the preceding month the temperature continued above the normal in all districts east of the 100th meridian, and many reports show that it has been the warmest February which has occurred in many years in the eastern districts of the United States. The temperature has fallen at the Rocky Mountain stations and in the districts on the Pacific coast, where it has ranged from 2° to 6° below the normal. An excess of 6°.5 is reported in the Lower Lake region and 6°.2 in the Middle States. In the western portion of the continent, especially in the northern districts, the temperature has been unusually low. The table of comparative temperatures for the several districts is printed on the right side of chart No. II.

The following notes are of interest as indicating the unusually high temperatures of the month in various sections: Houston, Ala., mildest winter for many years, the present month unusually warm. Sandy Springs, Md., month exceptionally warm. Waltham, Mass., mean temperature of the month 5° above the average. Westborough, Mass, remarkably mild month. Fall River, Mass., month unusually warm, no frost in ground. Litchfield, Mich., month very warm, frost entirely out of ground. Brookhaven, Miss., month unusually warm. Grafton, N. H., from the 10th to the 29th month unusually warm, five heavy thaws occurring during that period. Palermo, N. Y., warmest February in past 12 years. Cleveland, Ohio, warmest February in past 25 years, excepting 1857. Snowville, Va., month very warm and dry.

Minimum Temperatures.—Maine: —15° at *Orono and —12° at Eastport. *New Hampshire:* —27° on summit of Mt. Washington and —21° at *Dunbarton. *Vermont:* —22° at *Strafford and —12° at Burlington. *Massachusetts:* —20° at *Billerica, —5° at Boston and —6° at Springfield. *Rhode Island:* 2° at Newport. *Connecticut:* 2° at New Haven and New London. *New York:* —20° at *Schroon Lake, 1° at Buffalo, 2° at Oswego, —7° at *Ithaca, —10° at Albany and 10° at New York city. *Pennsylvania:* —12° at *Wellsboro, 2° at *Catawissa, 10° at Pittsburg and 12° at Philadelphia. *Delaware:* 18° at *Dover. *Maryland:* 0° at *Cumberland, 11° at *Woodstock, *Fallston, *Owing's Mills and *Sandy Springs and 15° at Baltimore. *District of Columbia:* 14° at Washington. *Virginia:* —1° at *Mt. Solon, 18° at Lynchburg and 22° at Norfolk. *West Virginia:* —6° at *Helvetia and 3° at Morgantown. *North Carolina:* 15° at *Franklin and *Highlands, 30° at Wilmington, and 33° at Cape Lookout. *South Carolina:* 36° at Charleston, and 31° at *Aiken. *Georgia:* 25° at *Gainesville and 31° at Atlanta, *Forsyth and *Thomasville. *Florida:* 34° at *Houston, 36° at Pensacola, 52° at Punta Rassa and 64° at Key West. *Alabama:* 28° at *Green Springs and 34° at Mobile. *Mississippi:* 27° at *Fayette and 31° at Vicksburg. *Louisiana:* 22° at *Okalooska, 29° at Shreveport and 43° at New Orleans. *Texas:* 1° at Ft. Elliott, 10° at Pilot Point, 19° at Ft. McKavett, 24° at Stockton and 37° at Edinburg and Brownsville. *Ohio:* 3° at *Bellefontaine, 19° at Cincinnati and 11° at Columbus, Cleveland and Toledo. *Kentucky:* 12° at *Bowling Green and 22° at Louisville. *Tennessee:* 7° at *Austin, 11° at Nashville, 25° at Memphis, and 28° at Chattanooga. *Arkansas:* 16 at *Mt. Ida and 32° at Little Rock. *Michigan:* —12° at Escanaba, —8 at Alpena and Marquette, 6° at Port Huron, 9° at Grand Haven and 11° at Detroit and *Lansing. *Indiana:* 7° at *New Corydon, 11° at Ft. Wayne, 14° at Indianapolis and 18° at *New Harmony. *Illinois:* —2° at *Geneseo and *Riley, 12° at Chicago, 13° at Springfield and 23° at Cairo. *Missouri:* 2° at *Corning and *Oregon, 7° at *Kansas City and 14° at St. Louis. *Kansas:* —4° at Dodge City, —3° at Ft. Leavenworth, 4° at *Manhattan and 8° at *Lawrence. *Wisconsin:* —20° at *Embarrass, —19° at *Neillsville, —5° at La Crosse and 0° at Madison. *Iowa:* —12° at *Cresco and *Nora Springs, —6° at *Glenwood, 1° at Des Moines, 2° at Dubuque and 9° at Keokuk. *Nebraska:* —23° at *Ft. Sidney, —8° at North Platte and *Ft. McPherson, and 0° at Omaha. *Indian Territory:* 15° at Ft. Gibson and 17° at Ft. Sill. *Minnesota:* —28° at *Breckenridge, —22° at Duluth and —18° at St. Paul. *Dakota:* —35° at Pembina, —23° at Deadwood, and —14° at *Morriston. *Colorado:* —17° at *Ft. Collins, —16° at *Hermosa and —8° at Denver. *New Mexico:* —3 at Santa Fé, 9° at Socorro, 17° at La Mesilla. *Wyoming:* —28° at * Ft. Fred Steele and —10° at Cheyenne. *Utah:* —19° at *Coalville and 3° at St. Lake City. *Nevada:* —26° at *Boca